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Todome

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(54) **FIXING DEVICE USED FOR IMAGE FORMING APPARATUS**

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(52) **U.S. Cl.** **399/18**; 399/22; 399/92

(58) **Field of Search** 399/18, 21, 22, 399/33, 92, 124, 81; 271/273, 272

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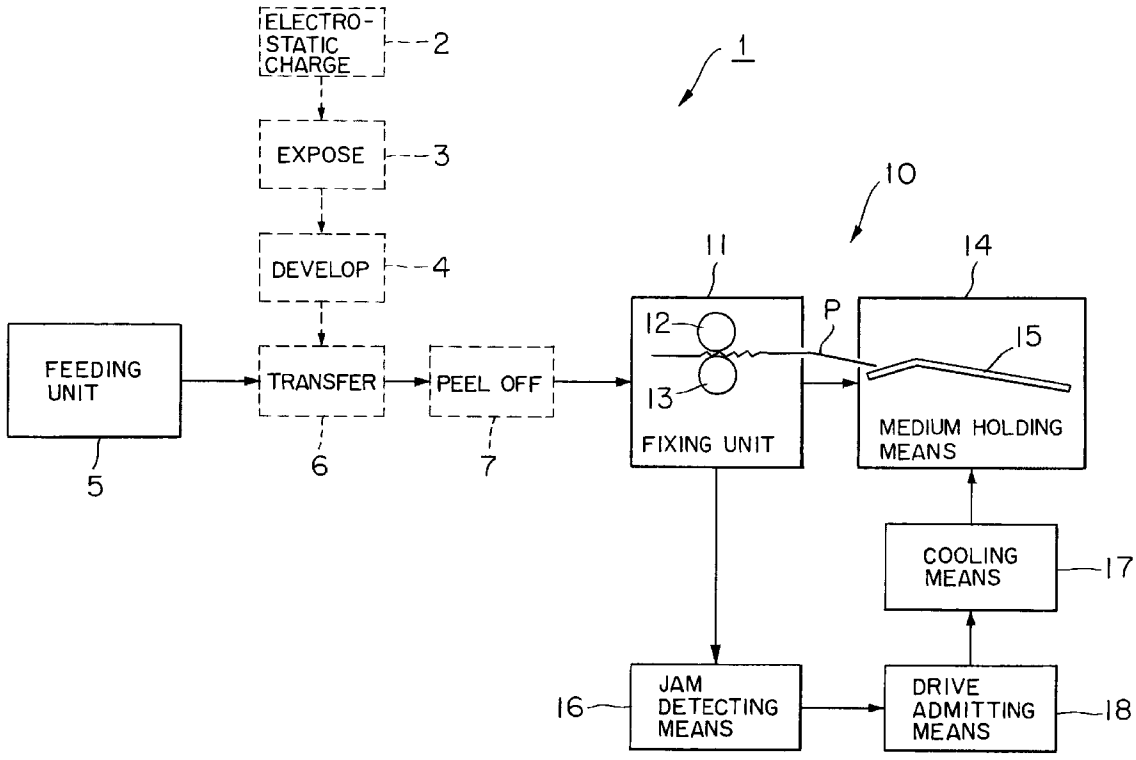
(57) **ABSTRACT**

An image forming apparatus is provided with an electrostatic charging unit, an exposure unit, a developing unit, a feeding unit, a transfer unit, a peeling-off unit, a fixing device and also a cooling mechanism used when taking out a jamming sheet in the fixing device. The fixing device consists of a fixing unit having fixing rollers and discharge guide unit for discharging a sheet after fixed by the fixing unit. The cooling mechanism, such as, a cooling fan or a refrigerant cooling unit, is provided at the discharge guide, to cool the jamming sheet that has caused jamming only in the fixing unit and discharged therefrom. Time for cooling the jamming sheet may be controlled by a user manual operation or for a predetermined period within a recovery allowable time, so as not to cool the fixing rollers, which would otherwise cause a long recovery time. Or, the cooling mechanism may start a cooling operation after detecting that a door provided at the front of the image forming apparatus has been opened for taking out the jamming sheet.

16 Claims, 8 Drawing Sheets



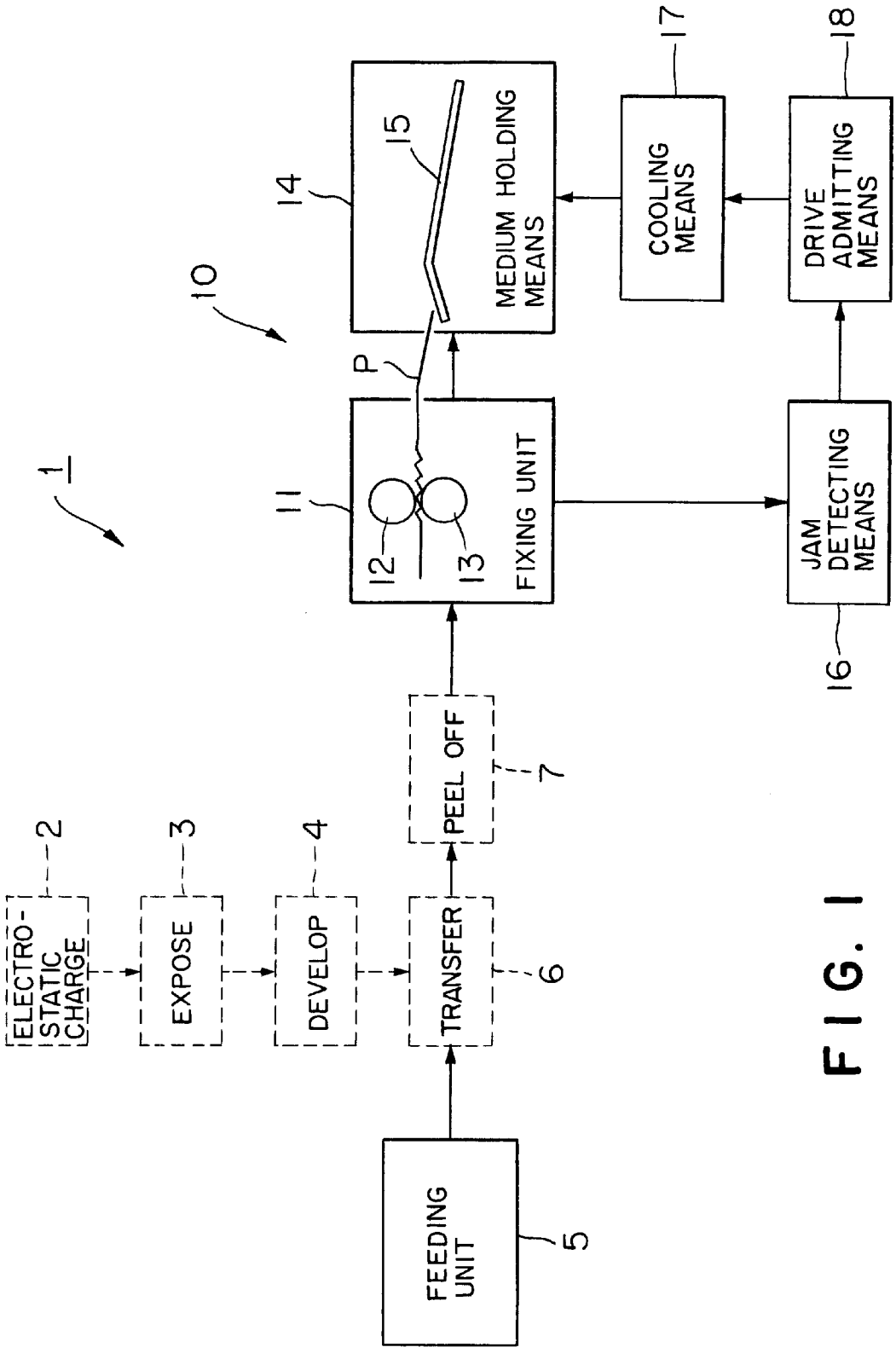

1
10
11
12
13
14
15
16
17
18
P
FIXING UNIT
MEDIUM HOLDING MEANS
COOLING MEANS
DRIVE ADMITTING MEANS
JAM DETECTING MEANS
PEEL OFF
7
ELECTRO-STATIC CHARGE
2
EXPOSE
3
DEVELOP
4
TRANSFER
6
FEEDING UNIT
5

FIG. 1

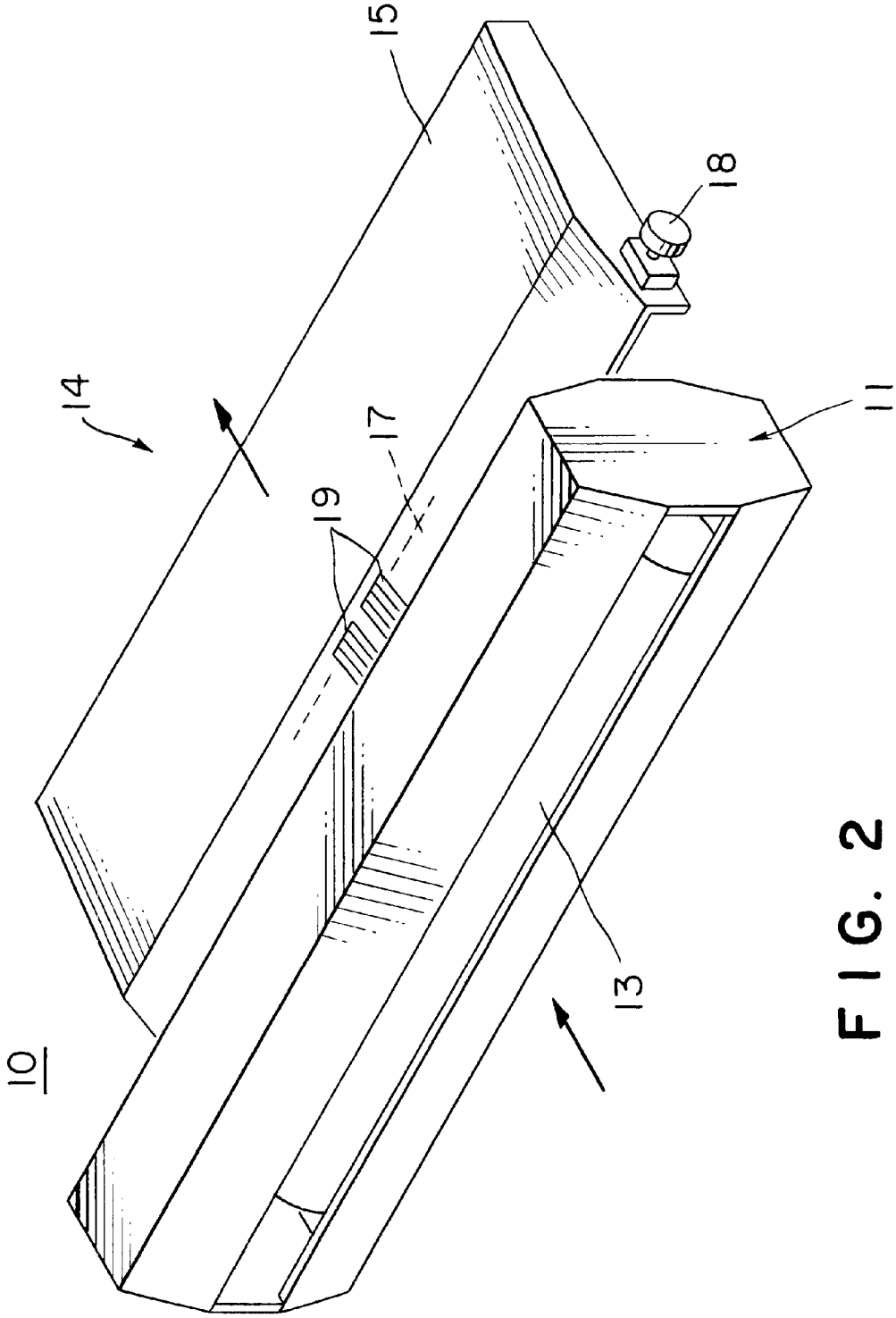


FIG. 2

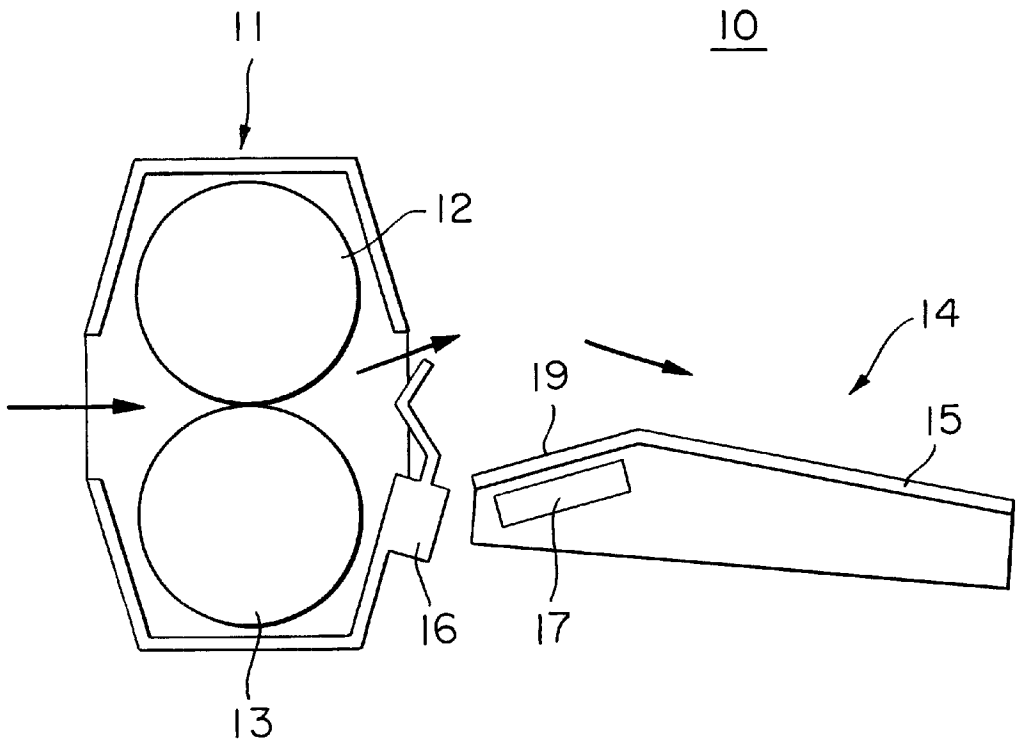


FIG. 3

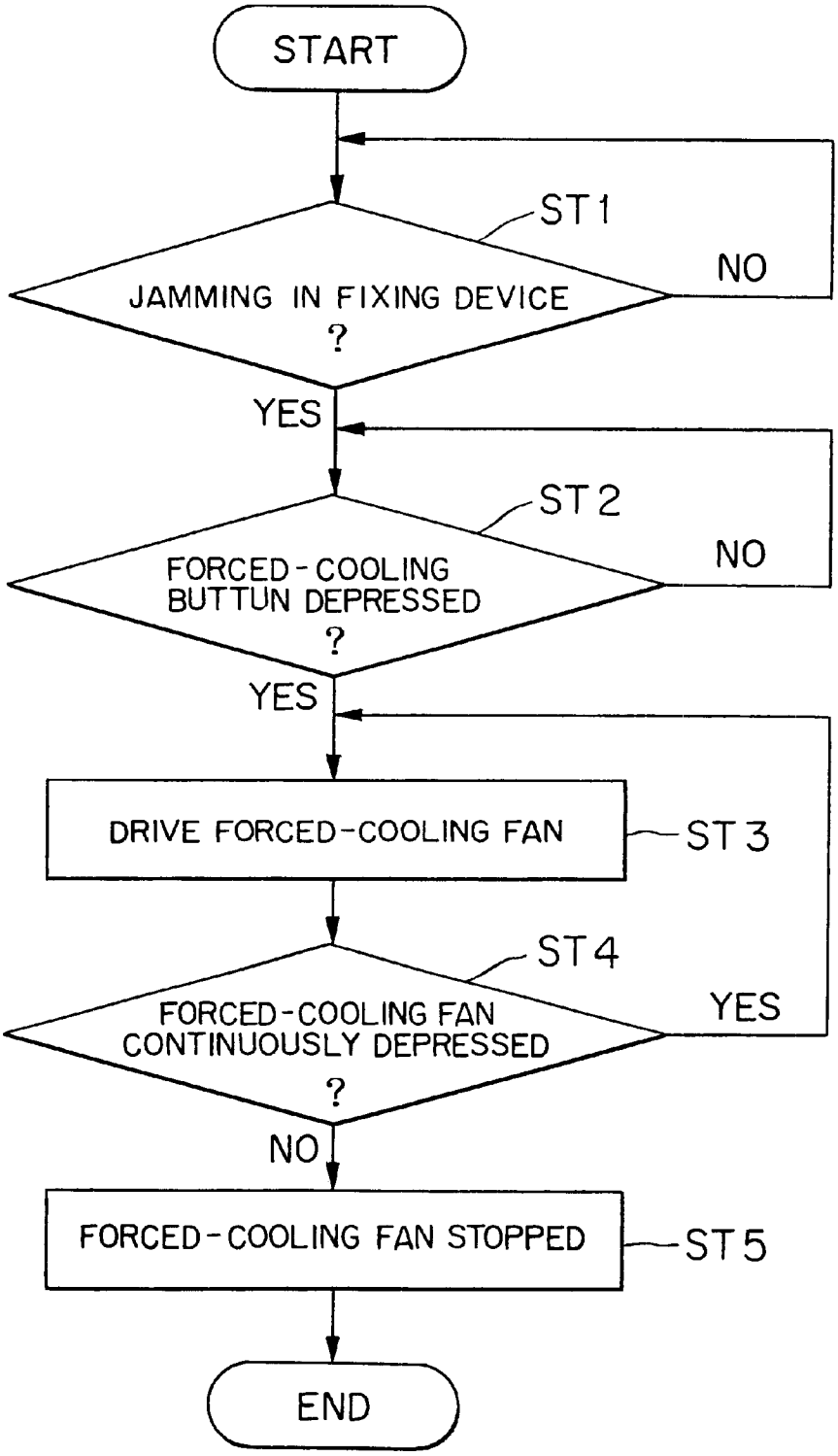

START
ST1
JAMMING IN FIXING DEVICE ?
NO
YES
ST2
FORCED-COOLING BUTTUN DEPRESSED ?
NO
YES
DRIVE FORCED-COOLING FAN
ST3
ST4
FORCED-COOLING FAN CONTINUOUSLY DEPRESSED ?
YES
NO
FORCED-COOLING FAN STOPPED
ST5
END

FIG. 4

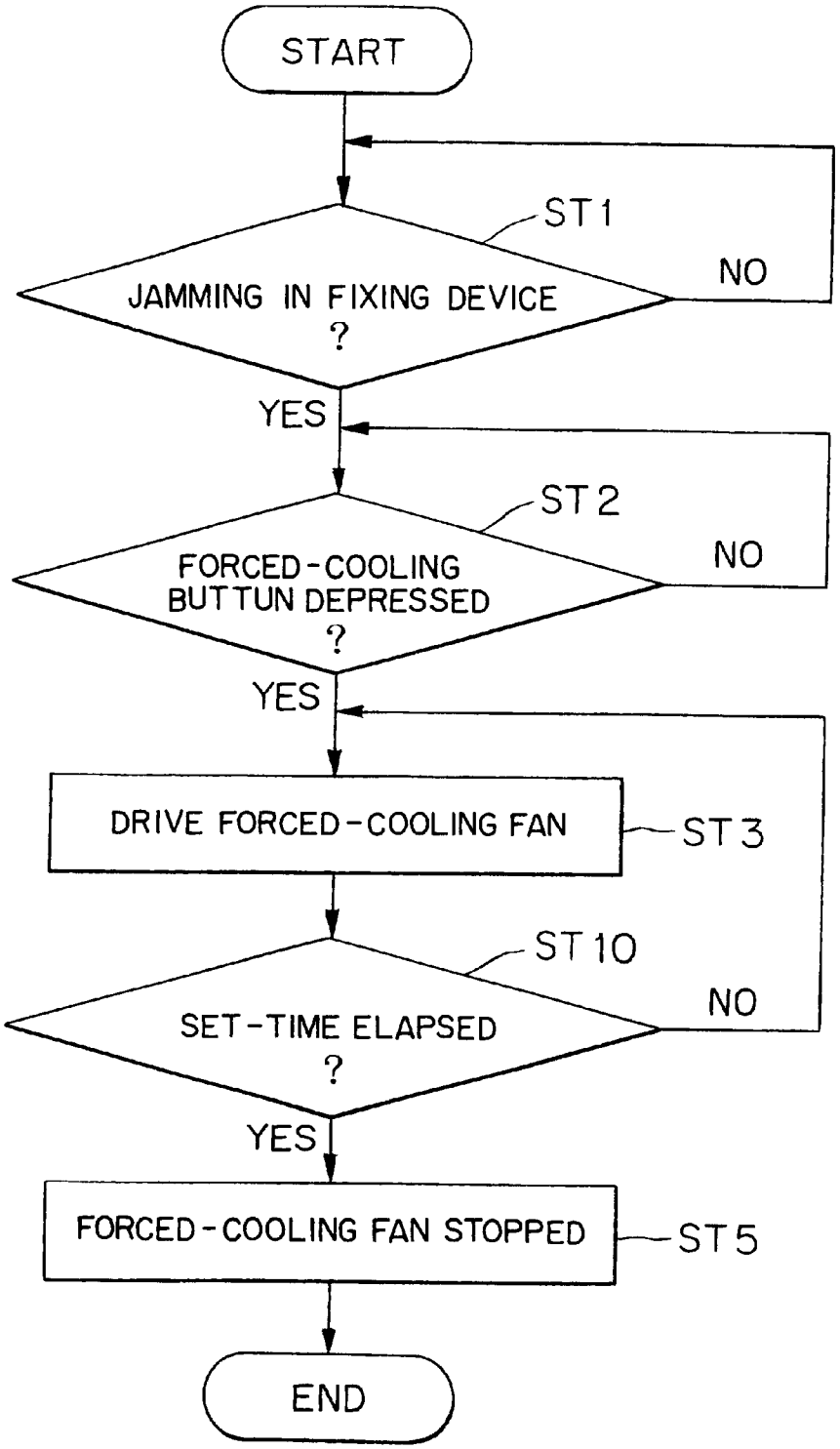

START
ST1
JAMMING IN FIXING DEVICE ?
NO
YES
ST2
FORCED-COOLING BUTTUN DEPRESSED ?
NO
YES
DRIVE FORCED-COOLING FAN
ST3
ST10
SET-TIME ELAPSED ?
NO
YES
FORCED-COOLING FAN STOPPED
ST5
END

FIG. 5

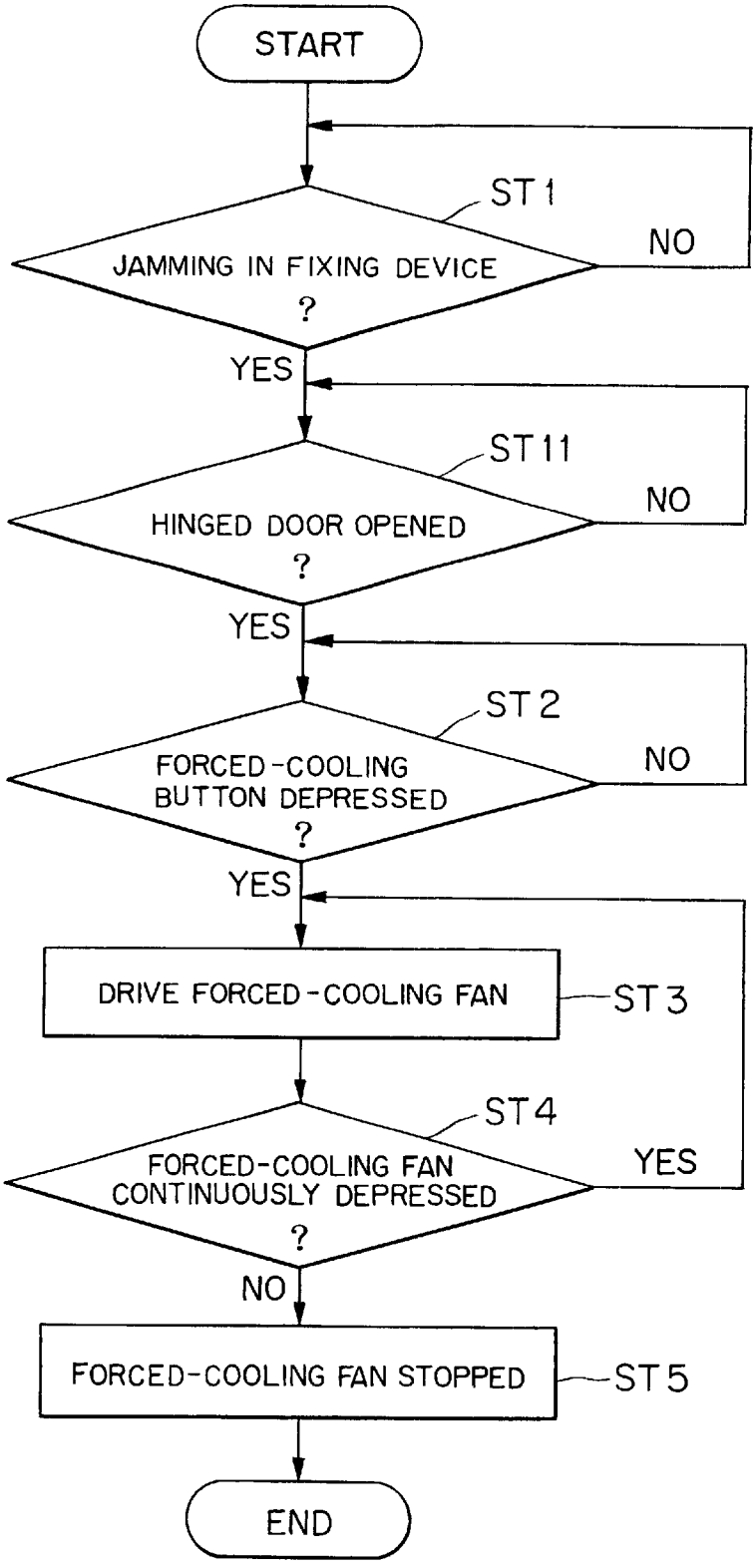

START
ST1
JAMMING IN FIXING DEVICE ?
NO
YES
ST11
HINGED DOOR OPENED ?
NO
YES
ST2
FORCED-COOLING BUTTON DEPRESSED ?
NO
YES
DRIVE FORCED-COOLING FAN
ST3
ST4
FORCED-COOLING FAN CONTINUOUSLY DEPRESSED ?
YES
NO
FORCED-COOLING FAN STOPPED
ST5
END

FIG. 6

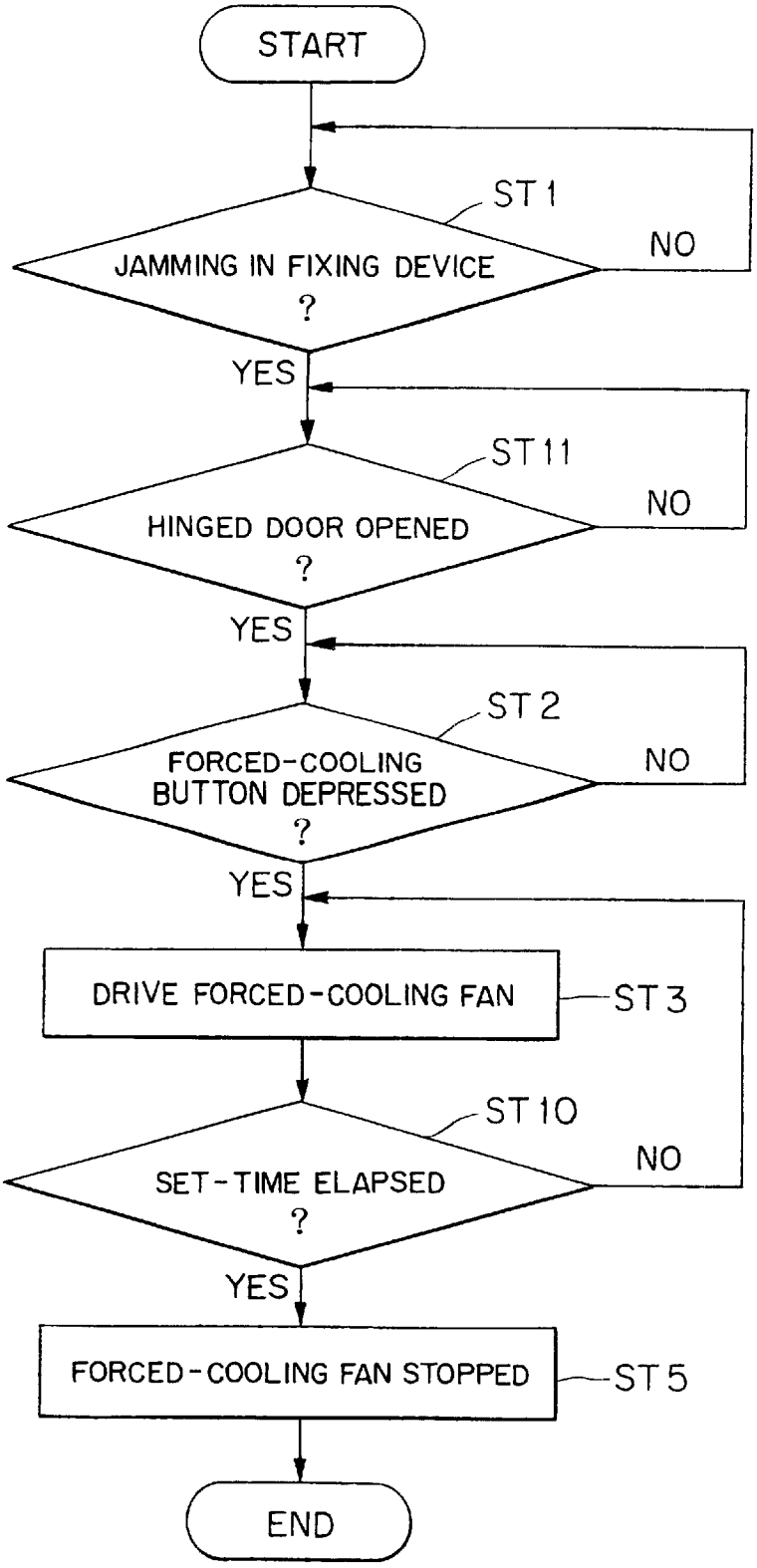

START
ST 1
JAMMING IN FIXING DEVICE ?
NO
YES
ST 11
HINGED DOOR OPENED ?
NO
YES
ST 2
FORCED-COOLING BUTTON DEPRESSED ?
NO
YES
DRIVE FORCED-COOLING FAN
ST 3
ST 10
SET-TIME ELAPSED ?
NO
YES
FORCED-COOLING FAN STOPPED
ST 5
END

FIG. 7

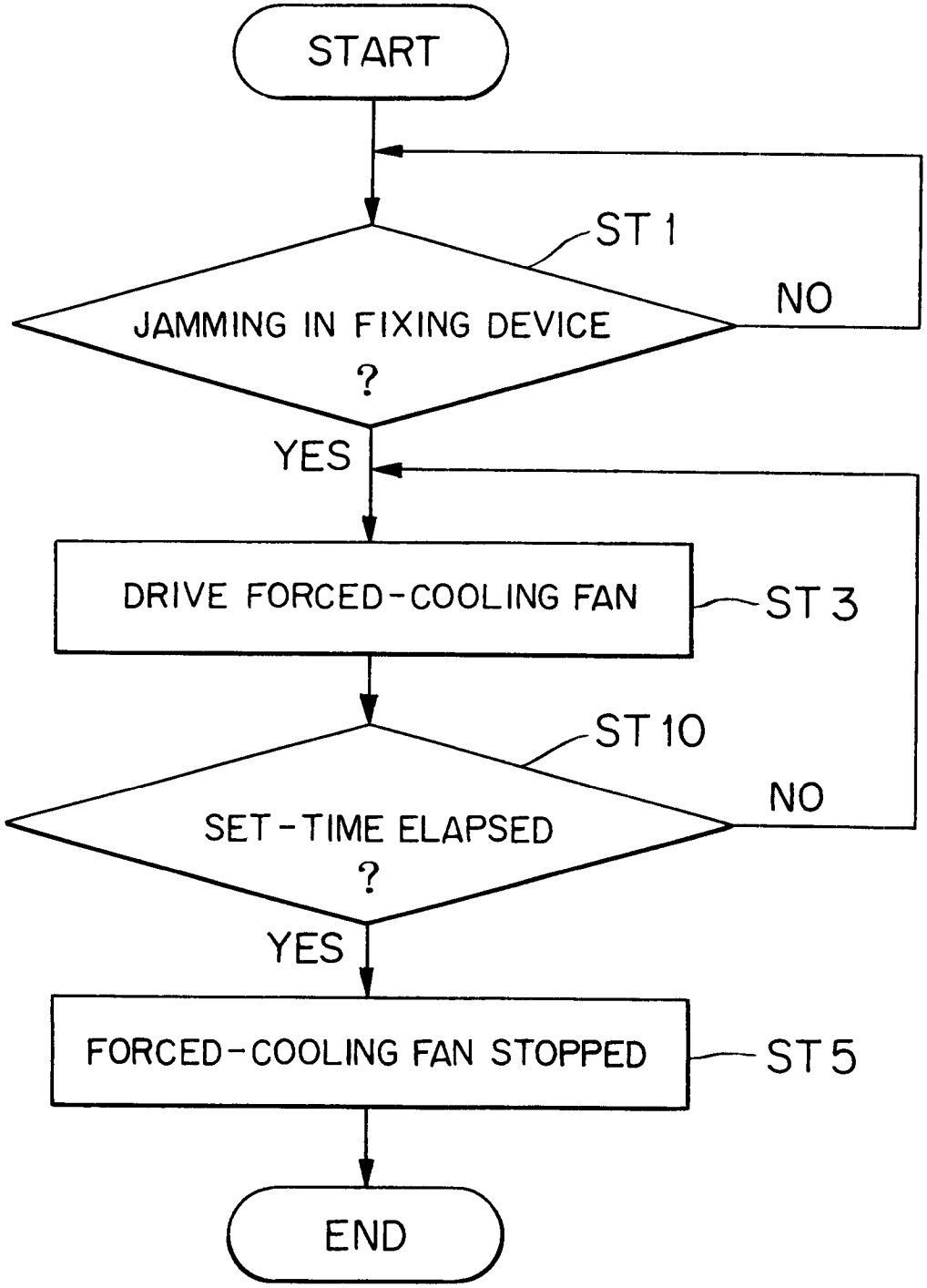

START
ST 1
JAMMING IN FIXING DEVICE ?
NO
YES
DRIVE FORCED-COOLING FAN
ST 3
ST 10
SET-TIME ELAPSED ?
NO
YES
FORCED-COOLING FAN STOPPED
ST 5
END

FIG. 8

FIXING DEVICE USED FOR IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to an image forming apparatus such as a plane paper color copy machine and a printer, for printing data transferred from an image data supplying apparatus such as a personal computer and a digital camera, on plane papers or OHP sheets. Particularly, this invention relates to a fixing device having a cooling mechanism for cooling a medium to be taken out when a paper jam occurs while fixing a color material deposited on the medium.

An image forming apparatus is generally equipped with an optical unit, an exposure unit, a developing unit, a paper-feeding unit, a transfer unit, a fixing unit, and so on.

The paper-feeding, transfer and fixing units would suffer a paper jam in which any of the units is jammed by sheets of paper as an image forming medium on which an image is formed.

A paper jam could occur anywhere in the units to which sheets are transferred. When a paper jam occurs in the fixing unit that has been generating a high heat, a user has to open a hinged door of an image forming apparatus to find a unit that has been suffering a paper jam for taking out the jamming sheets (a jam process).

Such a jam process annoys a user, particularly when it occurs to the fixing unit because jamming papers are often heated when a hinged door of an image forming apparatus is opened due to the facts that a paper jam occurs right after a fixing process or a heat-generating fixing unit is very close to the papers.

Rapid cooling to the fixing unit for taking out the jamming papers when a paper jam occurs around the fixing unit could cause temperature decrease to the fixing unit while toner has been attached to the unit, the cooled toner being hardly peeled off.

SUMMARY OF THE INVENTION

A purpose of the present invention is to provide an image forming apparatus having a cooling mechanism that offers a jam process without annoying a user when performed to a fixing unit, and without getting a fixing roller dirty by cooling only the outlet of the fixing unit and its peripheral.

In order to meet the purpose, a fixing device of an image forming apparatus according to the first basic configuration of the present invention is an fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device including: a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers; medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged from the fixing unit; jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving; cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism; and drive admitting means for admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image forming medium located in the vicinity of the medium holding means when the jamming image forming medium is detected by the jam detecting means.

The drive admitting means may include a manual switch that is provided inside a door provided at a front body of the image forming apparatus, for the cooling means to start by a user manual operation. Or, it may be an automatic drive admitting means by which a switch is turned on when the door provided at the front body is opened. Moreover, it is preferable that, under combination of the manual switch and automatic control, for example, the cooling means is automatically driven when the door is opened to cool at once the medium holding means and a jamming image forming medium that is located in the vicinity of the medium holding means, and the cooling means is stopped by means of the manual switch when the medium holding means and the jamming image forming medium have been cooled enough.

For drive admission by a manual operation, it is preferable that the drive mechanism of the cooling means is stopped when a user has not depressed the manual button anymore.

For automatic control, it is preferable that, after the driving mechanism of the cooling means has started to drive, cooling is performed for a fixed period in which the drive mechanism has continued driving until a predetermined period passes, and the drive mechanism automatically stops when the predetermined period has passed.

The cooling means may, in general, be constituted by a cooling fan as a cooling mechanism and a motor as a drive mechanism for rotating the cooling fan. The drive admitting means as a manual operating means thus can be an on-off switch for a cooling fan-driving motor. The cooling means may be constituted, as a unique configuration, by a cooling mechanism in which a refrigerant pipe is provided along the bottom of a receiving plate of the medium holding means, such as, a discharge transfer guide and a drive mechanism for cooling by circulating a refrigerant through the refrigerant pipe of the cooling mechanism.

Configured as above, when a paper jam occurs in the fixing unit, a discharge transfer guide at the discharge side and an image forming medium, such as, a jamming sheet that has been discharged to the discharge side only are cooled without cooling the fixing unit itself. Therefore, a user can take out an image forming medium caught in the fixing unit with no uncomfortable feeling when performing a jam process.

Moreover, the medium holding means, such as, a guide at the discharge side and an image forming medium, such as, a jamming sheet located in the vicinity of the medium holding means only are cooled without sending a cool wind or cool air to the fixing unit itself, thus no occurrence of attachment of toner, for example, to the fixing rollers due to cooling. The present invention thus achieves a cooling mechanism of a fixing device easy for post-processing.

A method of controlling a cooling mechanism of a fixing device according to the second basic configuration of the present invention is a method of controlling a cooling mechanism of a fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device including a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers, medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged by the fixing unit, jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving, and cooling means including a cooling mechanism for cooling the

medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism, the method including the steps of: detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving by the jam detecting means; and admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image forming medium located in the vicinity of the medium holding means.

In the method of controlling a cooling mechanism of a fixing device according to the second basic configuration, the step of admitting the drive mechanism to drive may include the step of driving the drive mechanism of the cooling means by a user manual operation.

In this method, the step of driving by the user manual operation may be performed by depressing a drive switch for starting the drive mechanism to drive the cooling mechanism.

In this case, it is preferable that the cooling means includes a cooling fan as the cooling mechanism for sending a specific airflow in a direction of the medium holding means and a drive motor as the drive mechanism for rotating the cooling fan, the step of driving by the user manual operation being performed by depressing a drive switch for starting the drive mechanism to drive the cooling fan provided in the vicinity of the fixing rollers.

Moreover, in this case, it is preferable that the cooling means includes a refrigerant cooling unit as the cooling mechanism that is provided at a transfer plate that is included in the medium holding means, for cooling the transfer plate by using a refrigerant and a refrigerant circulating unit for circulating the refrigerant of the refrigerant cooling unit, the step of driving by the user manual operation being performed by depressing a drive switch for driving circulation of the refrigerant of the refrigerant cooling unit provided at an outlet side of the fixing rollers.

In the method of controlling a cooling mechanism of a fixing device according to the second basic configuration, the step of admitting the drive mechanism to drive may include the steps of: generating a control signal based on the jam detected by the jam detecting means; and automatic admission step of automatically driving the cooling means based on the control signal.

In this method, the automatic admission step may include the steps of: detecting that a door provided at a front body of the image forming apparatus has been opened, thus outputting a drive admitting signal; and driving the drive mechanism of the cooling means based on the output drive admitting signal.

In this case, it is preferable that the cooling means includes a cooling fan as the cooling mechanism for sending a specific airflow in a direction of the medium holding means and a drive motor as the drive mechanism for rotating the cooling fan, the automatic admission step including the steps of: detecting that the door at the front body has been opened, and outputting the drive admitting signal to the drive motor; and driving the drive motor by means of the output drive admitting signal.

Furthermore, in this case, it is preferable that the cooling means includes a refrigerant cooling unit as the cooling mechanism that is provided at a transfer plate that is included in the medium holding means, for cooling the transfer plate by using a refrigerant and a refrigerant circulating unit for circulating the refrigerant of the refrigerant cooling unit, the automatic admission step including the steps of: detecting that the door at the front body has been opened, and outputting the drive admitting signal to the drive mechanism; and driving the drive mechanism by means of the output drive admitting signal.

Moreover, in this method, the automatic admission step may include the steps of: detecting that a door provided at a front body of the image forming apparatus has been opened, thus outputting a drive admitting signal; driving the drive mechanism of the cooling means based on the output drive admitting signal; and a manually operating step of manually operating a drive shut-down switch to stop the cooling mechanism.

Accordingly, the method of controlling a cooling mechanism of a fixing device according to the second basic configuration of the present invention can basically effectively drive the cooling mechanism of the fixing device according to the first basic configuration. The method thus achieves effective cooling to the medium holding means at the outlet side of the fixing unit and the image forming medium transferred and discharged onto the medium holding means, without cooling the fixing device itself, and also without making a user uncomfortable and attachment of toner to the main mechanism of the image forming apparatus.

BRIEF DESCRIPTION OF DRAWINGS

In the attached drawings:

FIG. **1** is a block diagram showing a basic structure of a fixing device having a cooling mechanism as the first embodiment according to the present invention;

FIG. **2** is a perspective view of a discharge guide unit having a fixing unit and a cooling mechanism of the fixing device according to the first embodiment;

FIG. **3** is a sectional view of the discharge guide unit having the fixing unit and the cooling mechanism of the fixing device according to the first embodiment;

FIG. **4** is a flow chart for explaining a cooling control operation of the fixing device according to the first embodiment;

FIG. **5** is a flow chart for explaining a cooling control operation of the fixing device according to the second embodiment;

FIG. **6** is a flow chart for explaining a cooling control operation of the fixing device according to the third embodiment;

FIG. **7** is a flow chart for explaining a cooling control operation of the fixing device according to the fourth embodiment; and

FIG. **8** is a flow chart for explaining a cooling control operation of the fixing device according to the fifth embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Preferred embodiments according to the present invention will be disclosed with reference to the attached drawings. Disclosed first is a fixing device having a cooling mechanism (a basic structure) as the first embodiment according to the present invention with reference to FIGS. **1** to **4**. FIG. **1** shows a block diagram of a fixing unit having a cooling mechanism as the first embodiment.

In FIG. **1**, an image forming apparatus **1** is provided with an electrostatic charging unit **2** to electrostatically charge a photo conductor drum; an exposure unit **3** to expose the charge drum to a document pattern; a developing unit **4** to

deposit a developer, such as, a toner on the pattern on the drum to form a toner image; a feeding unit **5** to feed sheets of paper as an image forming medium; a transfer unit **6** to transfer the toner image developed by the developing unit **4** to a sheet fed by the feeding unit **5**; a peeing-off unit **7** to peel off an excess toner from the transferred image; and a fixing device **10** to fix the toner on the transferred image by means of heat and pressure.

The fixing device **10** is used for an image forming apparatus for forming a toner image on a fixing body by an electrophotography process and fixing the image on an image forming medium to which the toner image has been transferred by means of heat and pressure.

The fixing device **10** is provided with a fixing unit **11** having a pair of fixing rollers **12** and **13** for fixing the image on the image forming medium with heat and pressure; a medium holding means **14**, situated at the outlet side of the fixing unit **11**, to transfer and discharge a sheet "P" as the image forming medium on which the image has been fixed; a jam detecting means **16** to detect jamming in which the fixing roller **12** and **13** have been stopped due to the sheet "P" as the image forming means got caught in the gap between the rollers; a cooling means **17** having a cooling mechanism for cooling the medium holding means **14** and the jamming sheet "P" as the image forming means and a drive mechanism for driving the cooling mechanism; and a drive admitting means **18** to admit the driving mechanism to drive the cooling mechanism to cool the medium holding means **14** and the jamming image forming medium adjacent to the medium holding means.

The medium holding means **14** has a transfer/discharge guide **15** for transferring and discharging the sheet "P" discharged from the fixing unit **11**.

Based on the basic structure shown in FIG. **1**, a structure of the cooling means **17** is disclosed with reference to FIGS. **2** and **3**.

As illustrated in FIGS. **2** and **3**, the fixing device **10** is constituted by the fixing unit **11** and a discharge/transfer guide **14** as the medium holding means. The fixing means unit **11** contains the fixing rollers **12** and **13**. A jam detecting sensor **16** as the jam detecting means is situated at the outlet side of the casing of the fixing unit **11**.

FIGS. **2** and **3** illustrate the fixing unit **11** to which a sheet as the image forming medium is transferred from left to right in the drawings. Such a sheet is often drawn as transferred from right to left for a usual image forming apparatus. The fixing unit is, however, drawn in FIGS. **2** and **3** in this specification such that a sheet is transferred in the same direction as that shown in FIG. **1** to match the state with each other. The direction illustrated in these drawings is decided in this specification for convenience. The arrows shown in FIGS. **2** and **3** represent the transferring and discharging direction for the sheet as image forming medium.

Attached under the discharge/transfer guide **14** at the fixing unit **11** side is a cooling fan **17** as the cooling means. On the guide **14** at the part along which the sheet discharged from the fixing unit **11** is guided and where the cooling fan **17** is attached, slits are formed in the direction of the arrows in FIGS. **2** and **3** in which the sheet is transferred as the image forming medium.

The slits constitute an opening **19** for cooling. The slits are formed in the direction of sheet transfer so that they will not obstruct the sheet transfer. Moreover, each slit width is narrow enough so that an operator cannot insert his or her finger into any slit while the cooling fan **17** is rotating, to secure safety.

The cooling fan **17** has a switch **18** provided in the vicinity of the fixing device **10** inside the image forming apparatus **1**, not on a control panel (not shown). If it were provided on the control panel, a regular operation could be obstructed because the control panel would be locked when a hinged door (not shown) of the apparatus **1** was opened for a jam process. The switch **18** provided in the vicinity of the fixing device **10** is noticeable for a user for ease of use.

The cooling fan **17** is driven to cool a jamming paper and also the heat rollers **12** and **13** a little, which makes long a copier recovery time after jamming.

In order to overcome such a problem, a manual operation only is offered to the switch **18**. In detail, the switch **18** is not automatically turned on when a jamming occurs in the fixing device **10** whereas it is turned on when a user depresses it while a jamming paper is heated too much for a user to take out. Moreover, the cooling fan **17** is not driven for a set time, but it is driven while the user is depressing the switch **18**.

FIG. **4** shows a flow chart for explaining an operation of the cooling mechanism of the fixing device in the first embodiment.

It is judged whether or not jamming occurs in the fixing device **10** in step ST**1**. Judged next is whether or not a user depresses the switch **18** for the cooling fan **17** in step ST**2**. If the force-cooling button **18** is judged as being depressed, the forced-cooling fan **17** is driven in step ST**3**. It is judged whether the forced-cooling button **18** has been still depressed in step ST**4**. If it is still depressed, the process goes back to step ST**3** in which the forced-cooling fan **17** is continuously driven to cool the top of the sheet that comes out after getting caught in the gap between the fixing roller **12** and **13** is shown.

When a user ceases depressing the force-cooling button **18**, it is judged in step ST**4** that the button **18** is not depressed anymore and then the forced-cooling fan **17** is stopped in step ST**5**.

The manual operation described above avoids an unnecessary cooling operation to the heat rollers at the most.

Jamming in the fixing device **10** could occur in front of and after the fixing unit **11**, however, will not generate heat so much at the front side. Moreover, the sheet caught in the gap between the fixing rollers **12** and **13** is taken out in the transfer direction. These are the reasons for providing the cooling fan **17** only at the downstream side of the fixing unit **11**.

The cooling fan **17** is controlled by the jam detecting sensor **16** and the switch **18**. In other words, it is driven only when the jam detecting sensor **16** detects jamming in the fixing device **10** and also the switch **18** is depressed.

Jamming occurring at places other than the fixing device **10** does not allow the cooling fan **17** to be driven even though a user unintentionally touches and depresses the switch **18** while opening the hinged door, thus avoiding unnecessary cooling of the heat rollers **12** and **13**.

The cooling mechanism in the first embodiment shown in FIGS. **1** to **4** performs cooling by a user manual operation except judgement on occurrence of jamming by the sensor **16**.

Not only this, the present invention offers a complete automatic cooling operation.

FIG. **5** shows a flow chart for explaining an operation of the cooling mechanism in the second embodiment.

The basic hardware for the second embodiment is the same as that for the first embodiment shown in FIGS. **1** to **3**.

In the second embodiment, an automatic cooling operation is performed for a set time when the forced-cooling button **18** is depressed.

It is judged whether or not jamming occurs in the fixing device **10** in step ST**1** by means of a detection signal from the jam detecting sensor **16**. If jamming is occurring, judged next is whether or not a user depresses the forced-cooling button **18** in step ST**2**. If it is depressed, the cooling fan **17** starts in step ST**3**. It is judged whether a set time has elapsed in step ST**10**. If not elapsed, the process goes back to step ST**3** to continuously drive the cooling fan **17**, whereas if elapsed, the process goes to step ST**5** to stop the cooling fan **17**.

The second embodiment shown in FIG. **5** offers an automatic cooling operation in which, once the switch button **18** is depressed, the forced-cooling fan **17** is driven for a set time by a timer to a jamming paper with no necessity of continuous switch depressing, thus avoiding a complex operation.

Care must be taken for taking out the jamming sheet P got caught between the fixing rollers, however, the second embodiment requires no continuous depressing of the forced-cooling button **18**, different from the first embodiment, thus the second embodiment achieves a quick jam process and a simple operation.

The third embodiment shown in FIG. **6** includes the step of judgement on whether or not the hinged door is opened, in addition to the steps for the first embodiment. The fourth embodiment shown in FIG. **7** also includes the step of judgement on whether or not the hinged door is opened, in addition to the steps for the second embodiment.

In FIG. **6** for a control operation to the cooling mechanism of the fixing device in the third embodiment, it is judged whether or not jamming occurs in the fixing device in step ST**11** by means of a detection signal from the jam detecting sensor **16**.

Judged next is whether or not a user has opened the hinged door in step ST**11**. If the hinged door is judged as being opened, the process follows the same steps shown in FIG. **4** for the first embodiment. A cooling operation continues to a jamming paper while the forced-cooling button **18** has been continuously depressed and when the button **18** is released in step ST**4**, the forced-cooling fan **17** is stopped in step ST**5**. Judgement on whether or not the front hinged door of the image forming apparatus **1** is opened is made by means of a detection signal from a sensor to detect contact between the apparatus body and the door.

FIG. **7** shows a flow chart for a control operation in the fourth embodiment, like the third embodiment shown in FIG. **6**, in which the forced-cooling fan **17** starts when the hinged door of the image forming apparatus **1** is detected to be opened and also the paper jamming is detected.

The difference between the third and the fourth embodiment is that, in the latter, judgement on elapse of a set time is made in step ST**10** before stopping the forced-cooling fan **17** in step ST**5**.

A control operation of the cooling mechanism in the fourth embodiment achieves double security by detection of the hinged door of the image forming apparatus **1** being opened and the paper jamming in the fixing device **10**.

The control operations of the cooling mechanism of the fixing device in the first to the fourth embodiments drives the cooling fan **17** to start by depressing the forced-cooling button **18**.

However, not limited to this, the invention includes a modification to start a cooling operation just after detection of a paper jamming and then stop the forced-cooling fan **17** when a set time elapses.

FIG. **8** shows a flow chart for explaining such a control operation of the cooling mechanism of the fixing device in the fifth embodiment.

In FIG. **8**, it is judged in step ST**1** whether or not a paper jamming has been occurring in the fixing device **10** based on a detection signal from the detector **16** as a jam detecting means. When there is a detection signal from the sensor **16** and it is judged that a paper jamming has been occurring in the fixing device **10**, the forced-cooling fan **17** is driven to start in step ST**3**. After that, it is judged in step ST**10** whether or not a set time has elapsed by a timer (not shown), for example. If before elapsing the set time, the process goes back to step ST**3** to continue driving of the cooling fan **17**. On the other hand, if it is judged in step ST**10** that the set time has elapsed, the forced-cooling fan **17** is stopped in step ST**5**.

The present invention may perform a completely automatic cooling control operation like the fifth embodiment with no manual switch operation when an object to be cooled by the cooling means **17** is not the heat rollers **12** but the top of a sheet caught in the gap between the rollers **12** and **13** at the outlet side of the fixing unit **11**.

The foregoing embodiments are disclosed with reference to FIGS. **1** to **3** where the forced-cooling fan **17** cools the sheet P as the image forming that has caused jamming, so as to avoid the cooling the fixing rollers.

However, not limited to this, for example, the present invention may employ the cooling means **17** constituted by a refrigerant cooling unit as a cooling mechanism provided under the transfer guide plate **15** configuring the medium holding means **14**, that cools the transfer guide plate **15** by means of a refrigerant and a refrigerant circulating unit as a driving mechanism to circulate the refrigerant in the refrigerant cooling unit.

In this configuration, the jam detecting means may include the jam detecting sensor **16** provided at the outlet side of the fixing rollers **12** and **13**, like the first embodiment, and the manual drive admitting unit **18** may include a driving switch for driving the refrigerant to circulate in the refrigerant cooling unit.

Moreover, an automatic control may be performed with an open-door detection switch as an automatic drive admitting unit, to detect an opened hinged-door of the image forming apparatus **1**.

As disclosed above, the cooling mechanism of the fixing device of the image forming apparatus according to the present invention includes a cooling fan or a refrigerant cooling mechanism as the cooling means attached to the transfer guide as the discharging unit provided at the outlet side of the fixing device to discharge an image forming medium. The cooling fan or the refrigerant cooling mechanism is driven while a user is depressing the forced-cooling button.

The present invention, when employing the cooling fan, is provided with slits as a cooling window in the direction of transferring copied sheets, at a portion of the transfer guide of the fixing devise, at the rear side of which the cooling fan is attached. The cooling window, the slits provided in the direction of transferring copied sheets, will not cause any problem on transfer. Moreover, each slit width of the cooling window is narrow enough so that a user cannot insert his or her finger into any slit while the cooling fan is rotating, thus causing no injury.

The switch for the cooling fan is provided, not on the control panel, but in vicinity of the fixing device in the image

forming apparatus. This is because, the control panel would be locked when the door is opened for jam processing, if such a switch is provided on the control panel; and also the switch provided at a place, such as in vicinity of the fixing device, is noticeable for a user, thus being user friendly.

Cooled by the cooling fan is not only jamming sheets but also the heat rollers which causes lengthening of a recovery time for a copier after jamming process.

To overcome such a drawback, the present invention is configured such that the cooling fan is not automatically driven whenever jamming occurs in the fixing device but it is driven only when a user depresses a switch who cannot take out a heated sheet or do not like to take out such a heated sheet.

Moreover, cooling is not performed for a set time, in other words, the cooling fan is driven while a user is depressing a switch. This arrangement achieves driving of the cooling fan only for a period required by a user, thus minimizing unnecessary cooling of heat rollers.

The cooling fan is provided only the outlet side of the fixing device for the following reasons:

Firstly, jamming would occur at any places before and after the fixing device, however, its occurrence before a sheet is taken into the fixing device mostly generates heat not so much for a user to take it out. Secondary, a jamming sheet in the fixing device is taken out after it is fed in the transferring direction.

The cooling fan is controlled according to an output of the jam detection sensor, furthermore, it is driven by depressing a switch only for jamming in the fixing device. In other words, the cooling fan does not start for jamming outside the fixing device even though the switch is depressed. This mechanism prevents unnecessary cooling of heat rollers.

The same advantages are given by the cooling fan that is configured by the refrigerant cooling mechanism as disclosed in the fifth embodiment.

The refrigerant-cooling mechanism does not spatter heat soon caused by jamming because it is not an air-cooling system like the cooling fan. In other words, the refrigerant-cooling mechanism sends a cooled air directly to a jamming sheet via the guide plate **15** so that no cooled air is not sent toward the heat rollers **12** and **13**, thus the rollers being prevented from cooling.

What is claimed is:

1. A fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device comprising:

a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers;

medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which image has been fixed, transferred and discharged from the fixing unit;

jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving;

cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism; and

drive admitting means for admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image holding medium located in the vicinity of the medium holding means when the jamming image forming medium is detected by the jam detecting means,

wherein the drive admitting means includes a manual drive admitting unit for manually admitting the cooling means to be driven.

2. The fixing device according to claim **1**, wherein the manual drive admitting unit includes a drive switch for starting the drive mechanism to drive the cooling mechanism.

3. The fixing device according to claim **2**, wherein the cooling means includes a cooling fan as the cooling mechanism for sending a specific airflow in a direction of the medium holding means and a drive motor as the drive mechanism for rotating the cooling fan, the manual drive admitting unit having the drive switch for driving the drive motor for the cooling fan.

4. The fixing device according to claim **2**, wherein the cooling means includes a refrigerant cooling unit as the cooling mechanism that is provided at a transfer plate that is included in the medium holding means, for cooling the transfer plate by using a refrigerant and a refrigerant circulating unit as the drive mechanism for circulating the refrigerant of the refrigerant cooling unit, the manual driving admitting unit having the drive switch for driving circulation of the refrigerant of the refrigerant circulating unit provided at an outlet side of the fixing rollers.

5. A fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device comprising:

a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers;

medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged from the fixing unit;

jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving;

cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism; and

drive admitting means for admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image holding medium located in the vicinity of the medium holding means when the jamming image forming medium is detected by the jam detecting means,

wherein the drive admitting means includes an automatic drive admitting unit for automatically admitting the cooling means to be driven according to a predetermined control signal after the jam has been detected in the jam detecting means, and

wherein the automatic drive admitting unit includes a door-open detecting switch for detecting that a door provided at a front body of the image forming apparatus has been opened, thus outputting a drive admitting signal.

6. The fixing device according to claim **5**, wherein the cooling means includes a cooling fan as the cooling mechanism for sending a specific airflow in a direction of the medium holding means and a drive motor as the drive mechanism for rotating the cooling fan, the automatic drive

admitting unit having the door-open detecting switch for detecting that the door has been opened and outputting the drive admitting signal to the drive motor.

7. The fixing device according to claim **5**, wherein the cooling means includes a refrigerant cooling unit as the cooling mechanism that is provided at a transfer plate that is included in the medium holding means, for cooling the transfer plate by using a refrigerant and a refrigerant circulating unit as the drive mechanism for circulating the refrigerant of the refrigerant cooling unit, the automatic driving admitting unit including the door-open detecting switch for detecting that the door has been opened, thus outputting the drive admitting signal to the drive mechanism.

8. A fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device comprising:

a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers;

medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged from the fixing unit;

jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving:

cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism; and

drive admitting means for admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image holding medium located in the vicinity of the medium holding means when the jamming image forming medium is detected by the jam detecting means,

wherein the drive admitting means includes an automatic drive admitting unit for automatically admitting the cooling means to be driven according to a predetermined control signal after the jam has been detected by the jam detecting means, and

said fixing device further comprising a manual drive admitting for manually admitting the cooling means to be driven by controlling the automatic drive admitting unit, the manual drive admitting unit including a drive switch for starting the drive mechanism to drive the cooling mechanism, the automatic drive admitting unit including a door-open detecting switch for detecting that a door provided at a front body of the image forming apparatus has been opened, thus outputting a drive admitting signal.

9. A method of controlling a cooling mechanism of a fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device including a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers, medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged by the fixing unit, jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving, and cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism, the method comprising the steps of:

detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving by the jam detecting means; and

admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image forming medium located in the vicinity of the medium holding means,

wherein step of admitting the drive mechanism to drive includes the step of driving the drive mechanism of the cooling means by a user manual operation.

10. The method of controlling the cooling mechanism of the fixing device according to claim **9**, wherein the step of driving by the user manual operation is performed by depressing a drive switch for starting the drive mechanism to drive the cooling mechanism.

11. The method of controlling the cooling mechanism of the fixing device according to claim **10**, wherein the cooling means includes a cooling fan as the cooling mechanism for sending a specific airflow in a direction of the medium holding means and a drive motor as the drive mechanism for rotating the cooling fan, the step of driving by the user manual operation being performed by depressing the drive switch for starting the drive mechanism to drive the cooling fan provided in the vicinity of the fixing rollers.

12. The method of controlling the cooling mechanism of the fixing device according to claim **10**, wherein the cooling means includes a refrigerant cooling unit as the cooling mechanism that is provided at a transfer plate that is included in the medium holding means, for cooling the transfer plate by using a refrigerant and a refrigerant circulating unit for circulating the refrigerant of the refrigerant cooling unit, the step of driving by the user manual operation being performed by depressing the drive switch for driving circulation of the refrigerant cooling unit provided at an outlet side of the fixing rollers.

13. A method of controlling a cooling mechanism of a fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device including a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers, medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged by the fixing unit, jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving, and cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism, the method comprising the steps of:

detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving by the jam detecting means; and

admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image forming medium located in the vicinity of the medium holding means,

wherein the step admitting the drive mechanism to drive includes the steps of:

generating a control signal based on the jam detected by the jam detecting means: and

automatic admission step of automatically driving the cooling means based on the control signal, and

wherein the automatic admission step includes the steps of:

detecting that a door provided at a front body of the image forming apparatus has been opened, thus outputting a drive admitting signal; and

driving the drive mechanism of the cooling means based on the output drive admitting signal.

14. The method of controlling the cooling mechanism of the fixing device according to claim **13** wherein the cooling means includes a cooling fan as the cooling mechanism for sending a specific airflow in a direction of the medium holding means and a drive motor as the drive mechanism for rotating the cooling fan,

the automatic admission step including the steps of:

detecting that the door at the front body has been opened, and outputting the drive admitting signal to the drive motor; and

driving the drive motor by means of the output drive admitting signal.

15. The method of controlling the cooling mechanism of the fixing device according to claim **13** wherein the cooling means includes a refrigerant cooling unit as the cooling mechanism that is provided at a transfer plate that is included in the medium holding means, for cooling the transfer plate by using a refrigerant and a refrigerant circulating unit for circulating the refrigerant of the refrigerant cooling unit,

the automatic admission step including the steps of:

detecting that the door at the front body has been opened, and outputting the drive admitting signal to the drive mechanism; and

driving the drive mechanism by means of the output drive admitting signal.

16. A method of controlling a cooling mechanism of a fixing device of an image forming apparatus, heated and fixed by which is an image forming medium transferred on which is a toner image formed on an image fixing body by an electrophotography process, the fixing device including a fixing unit that presses and heats the image forming medium to be fixed by a pair of fixing rollers, medium holding means provided at an outlet side of the fixing unit for holding the image forming medium, on which an image has been fixed, transferred and discharged by the fixing unit, jam detecting means for detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving, and cooling means including a cooling mechanism for cooling the medium holding means and jamming image forming medium and a drive mechanism for driving the cooling mechanism, the method comprising the steps of:

detecting a jam in which the image forming medium has been caught between the fixing rollers and not moving by the jam detecting means; and

admitting the drive mechanism to drive the cooling mechanism to cool the medium holding means and the jamming image forming medium located in the vicinity of the medium holding means,

wherein the step admitting the drive mechanism to drive includes the steps of:

generating a control signal based on the jam detected by the jam detecting means; and

automatic admission step of automatically driving the cooling means based on the control signal, and

wherein the automatic admission step includes the steps of:

detecting that a door provided at a front body of the image forming apparatus has been opened, thus outputting a drive admitting signal;

driving the drive mechanism of the cooling means based on the output drive admitting signal; and

a manually operating step of manually operating a drive switch to stop the cooling mechanism.

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